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NEOCOMIAN FOSSILS

The Fossils and Palæontological Affinities of the Neocomian Deposits of Upware and Brickhill. Being the Sedgwick Prize Essay for 1879. By Walter Keeping, M.A., F.G.S. Large 8vo, pp. 167, with eight plates of fossils. (Cambridge, 1883.)

PHOSPHATIC deposits may be said to occur, in this country, on all horizons from the Bala limestone to the crag, yet do they most abound in the "strata below the chalk," and particularly in those portions of the Cretaceous system which underlie the chalk of the south-east Midlands. Thus Cambridge is almost as famous for its *coprolites* as Newcastle for its *coals*, and the economic inferiority of the Mesozoic rocks has of late years been partially redeemed, in consequence of the numerous workings in these valuable beds.

The immense collections of fossils from the several "phosphate diggings," now in the Woodwardian Museum, afford those who have watched the growth of these accumulations a splendid opportunity for studying an unusually rich vein of palæontology, and at the same time of forming more correct views as to the physical history of these much debated deposits.

The coprolite beds *beneath the gault* at Upware were vigorously worked some sixteen years ago, but as the phosphates were inferior in quality, the work presently slackened, though not before large quantities of fossils had been secured by gentlemen from Cambridge, who have ever been foremost in studying these and the allied deposits. The workings at Little Brickhill were described by the author himself in the *Geological Magazine* (volume for 1875, p. 372), but since then the knowledge of its fauna has been largely increased, "so that the Brickhill bed is now only second to Upware and Farringdon in its organic richness." Recently (1879) the Upware sections have again been exposed.

There can be no doubt that Mr. Walter Keeping is very well qualified to perform the task he has undertaken, and that the Sedgwick Prize Essay for 1879 must rank as one of the most useful contributions to Neocomian geology and palæontology that has appeared in this country. It is, in fact, the outcome of a long experience judiciously applied. The author summarises his own work in the preface, so that readers may know what they have to expect: his conclusions as to the age of the ironsand and phosphatic series are stated to be in near accordance with the opinions of Messrs. Walker, Teall, Meyer, and Barrois, "all of whom have placed the Upware bed in the Upper Neocomian or Aptian series (Lower Greensand)." The *mammillaris* zone he regards as the basement bed of the gault, and to this horizon refers the Downham phosphate bed.

The first part of the work deals with the deposits generally, the indigenous fauna, the "derived" fossils, the British and foreign relations of the beds. The second part is devoted to special palæontology.

In discussing the question of phosphatisation he observes that the nodules of Upware and Brickhill have been derived, for the most part, from the Upper Jurassic

rocks, where as a rule the majority of the Jurassic fossils are *not phosphatised at all*: and he concludes from the similarity in the general character of the phosphate of lime nodules, whether from Oxford Clay, Kimmeridge Clay, or Portlandian Rock, that the phosphatic matter was derivative, and all, or nearly all of one age. At page 30 he speaks of a coprolite heap near Ampthill, as looking like one mass of *Ammonites biplex*, mostly worn and fragmentary, whilst the Ammonites of the Oxford Clay are composed of limonite, and some of the fragments of fossil wood are silicified. Strangest fact of all—the Coral Rag fossils from the neighbouring rock have not been phosphatised in the least. The author (p. 15) suggests that this purer form of carbonate of lime was "uncongenial to the phosphatic matter," which would have more affinity for argillaceous substances, and yet he quotes the case of a stalagmitic deposit having become phosphatised by percolation.

It is not a little suggestive that whilst *Ammonites biplex* from the Upper Kimmeridge (Middle Portlandian of the French) is phosphatised in heaps, the Oxford Clay Ammonites are in the condition of limonite. This seems to show that *original conditions* have had something to do with the case. Both Oxford Clay and Kimmeridge Clay Ammonites and casts are often pyritised in their own beds; on the other hand, the Kimmeridge Clay as a rule, especially in the Valley of Aylesbury, has all the appearance of being rich in phosphatic matter. The process of replacement, therefore, whereby the fossil cast became the phosphatic nodule, may have been inaugurated during the progress of denudation, assisted possibly by accumulations of contemporary animal matter due to abundant aquatic and semi-aquatic life. In this way the phosphatisation was probably completed shortly after emergence, and the future coprolites were collected in banks and shallows, to be distributed subsequently, along with lydites and anything that could stand knocking about by the action of waves and currents, throughout the shore deposits of a slightly later period. Hence we venture to suggest that the phosphatisation of the Upware coprolites was effected at some distance from their present billet, and thus that the fragments of Coral Rag were never exposed to the temptation of having their carbonic acid replaced by phosphoric.

The principal object of the essay is of course to describe the indigenous fauna, and to correlate the deposits generally with others of the period, whether British or foreign; the similarity of the Upware and Brickhill fossils to those of the Neocomian beds of the Brunswick area at Shöppenstedt and Berklingen being especially mentioned (p. 73). This, together with the special palæontology, has been very satisfactorily worked out. We have already alluded to the general conclusion based on these investigations, and it only remains to notice some of the more detailed matters.

For instance (p. vi.), the author notes the close palæontological relationship of the ironsand and phosphatic series as found at Upware, Potton, Brickhill, and Farringdon, the great difference in the fauna at Potton being due, he conceives, to the influence of physical conditions. He further alludes to the *special* character of the native forms of life, and to the marked preponderance of Brachiopods, Polyzoa, and Sponges; to the profusion of Brachiopod

shells, both individually and specifically, and the gradation of the various types (species) into one another (p. 22).

In dealing with this latter subject the author has possessed unusual facilities, since himself and his father have availed themselves of the 15,000 Brachiopods collected from Brickhill to arrange sets of connecting forms between recognised species of *Terebratula*, *Waldheimia*, and *Terebratella*. It must not be supposed that between all the species enumerated the connecting morphological varieties are equally evident or of equally frequent occurrence: between some species the passage is simple and clear, both as to the main line and the offshoots, whilst between others much more searching is required to establish the connecting series.

Brickhill indeed seems to have been a centre, as regards the Brachiopoda, of inordinate fecundity accompanied by considerable inosculation of form, just one of those places, in fact, where the oft-demanded missing link was manufactured on a large scale, whilst at Upware and other places on the same horizon the form-groups known as "species" had somewhat contracted their circle of variation. Doubtless almost every zoological group has had its Brickhills in the course of ages, though the chances of preservation and subsequent discovery must limit the number accessible to research. Mr. Keeping, having given us valuable and cogent proofs of the mutability of the forms of Brachiopoda, and apparently somewhat uneasy as to the results of his own conclusions, proceeds to assure us that the value of "species" has been considerably enhanced by these investigations both to the naturalist and the stratigraphist.

Glancing briefly at the part devoted to special palæontology, we learn that the vertebrate remains of Upware are in a great part truly Neocomian species native to the deposit. The probable identity of form of some of the palatal teeth of Jurassic and Neocomian species is insisted on especially in the case of *Sphærodus*.

Coming to the Invertebrata, we find that Cephalopoda are by no means individually numerous; they are for the most part well-known Aptian species. Neither are the Gasteropoda at all plentiful, though some new species are described, including two of *Nerinea*, both very rare. This is the more remarkable as the uppermost Jurassic rocks of England are, as far as we know, devoid of this genus. The oysters form an important feature, and, excluding the plaited species, greatly resemble those of the Jurassic rocks. Mr. Keeping is convinced that the shell he refers to *Gryphæa dilatata*, Sow., is a genuine native. It is somewhat singular that the Oxfordian *G. dilatata* should have been resuscitated rather than the Portland-Kimmeridge *Ostrea expansa*, Sow., which swarms in the Upper Kimmeridge (Middle Portlandian) of Bucks and in the Portland stone of several localities. On the whole there is a fair list of Monomyaria, including some new species.

Of the Dimyaria one species of *Trigonia* occurs, and is restricted, it would seem, to Upware. The Arcadæ are well represented, three species of *Pectunculus* being given. Of the remaining genera *Cypricardia* and *Cyprina* have the most species, but none are quoted as abundant, though some new species are described. The Brachiopoda, Polyzoa, and Sponges, as every one knows, make up

the bulk of the fossils, many of the latter being identical with those of Farringdon.

The table tells us that 151 species are listed from Upware and 88 from Brickhill. Of these 45 occur at Farringdon, 39 at Godalming, 24 at Speeton, 21 at Pottton, 19 at Tealby, Shanklin, and Atherfield respectively, 16 in the Hythe beds, 6 in the Folkestone beds, 1 in the Hunstanton Red Chalk, and a doubtful case in the Folkestone Gault.

The book is conveniently got up, not being too large, is well illustrated by Foord, and altogether forms a most desirable volume for the Mesozoic geologist.

W. H. H.

OUR BOOK SHELF

Sound and Music. By Sedley Taylor. Second Edition. (London: Macmillan and Co., 1883.)

THAT this excellent elementary work has at last reached a second edition is certainly in one respect satisfactory. But that nine years should have been occupied in the process, while the "popular" rubbish of the paper scientists has in many cases (or at least is proclaimed as having) annual or biennial reproduction, is matter for profound regret and meditation.

We noticed so fully (*NATURE*, vol. x. p. 496) the first edition of Mr. Taylor's work, that it is not necessary to say much now. Some of the parts to which we formerly took exception have been considerably modified; in all cases but one, we think, for the better. The one exception is that about the use of the word *force* (or opposite systems of forces) in the explanation of the mutual destruction of sounds by interference.

The word "*timbre*" has been excised, and its place supplied by "quality"; but the hideous misuse of the English word "clang" in the sense of a harmonious combination of sounds still disfigures the later pages. It is time that a definite and suitable nomenclature should be once for all introduced into this part of the subject. There are many words, such as "sound," "note," "tone," &c., which every one seems to think himself entitled to employ as it pleases him, even to the extent of using one of them occasionally in two perfectly incompatible senses. But almost anything would be preferable to a literal transcription of Helmholtz's words into an English book, without regard to the inevitable incongruities.

Southern and Swiss Health Resorts. By William Marcet, M.D., F.R.S. 12mo, pp. 408. (London: Churchill, 1883.)

Nice and its Climate. By Dr. A. Baréty, translated, with additions, by Charles West, M.D. 12mo, pp. 162. (London: Edward Stanford, 1882.)

THIS work of Dr. Marcet is written in an easy, popular style, and gives people very much the sort of information they want. It begins with advice to invalids about to visit the Riviera regarding dress and food, next has something to say regarding hotels, boarding-houses, apartments, and villas; gives some general ideas of social life in the health resorts of the Mediterranean coast, and then proceeds to a more purely climatological description of the Riviera in general and of the particular characteristics of the different towns upon it. Dr. Marcet's residence for some years on the Riviera gives his description of the health resorts there all the accuracy and fulness, without unnecessary detail, which personal acquaintance alone can secure. The same may be said of his description of the health resorts of Switzerland, and his account of the Swiss resorts at low or moderate elevations are particularly interesting and useful. As a guide to invalids the